



# Chemical Safety and Security Officer Training

Egypt  
26–27 October, 2011



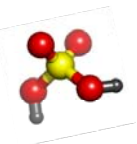
SAND No. 2009-8385P  
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.




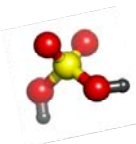


# Welcome, Purpose, Goal, Overview




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# Introduction of Staff and Participants



# Chemical Safety and Security Overview



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## Why worry about chemical safety?



- Chemicals used everyday in labs and factories can be hazardous.

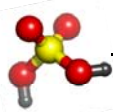




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## Possible chemical health problems

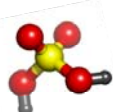


<u>Chemicals</u>	<u>Diseases</u>
▶ Vinyl chloride	▶ Liver cancer
▶ Asbestos	▶ Mesothelioma
▶ Carbon tetrachloride	▶ Hepatotoxin (jaundice)
▶ Mercury	▶ Neurotoxin, CNS, narcosis
▶ Lead	▶ Reprotoxin, birth defects
▶ Thalidomide	▶ Reprotoxin, developmental defects
▶ Methanol	▶ Blindness, death
▶ CO, CS <sub>2</sub>	▶ Hematopoietic, hemoglobin, cyanosis




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## But disease depends on many factors...



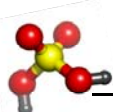
- ▶ Genetics
- ▶ Specific chemical
- ▶ Protection controls used
- ▶ Dose
- ▶ Concentration
- ▶ Duration
- ▶ Life style
- ▶ Environment

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## University of California Santa Cruz: Fire



January 11, 2002:  
about 5:30 am, 4<sup>th</sup> floor of  
Sinsheimer Lab building, Dept. of  
Molecular, Cell and  
Developmental Biology.

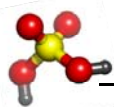
- Firefighters responded to alert from heat-detection system in building.
- Controlled by noon.
- Up-to-date inventory of hazardous materials allowed firefighters to enter building and contain fire.
- Building did not have automatic sprinkler system.



<http://ehs.ucsc.edu/emergency/sinshfire2.htm>

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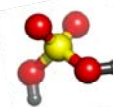


## University of California Santa Cruz: Fire, cont'd.

- ▶ Professors and students lost equipment, notes, materials, samples.
- ▶ Other labs in building closed for weeks to months.
  - Water and smoke damage
- ▶ Burned labs took 2 years to reopen.
- ▶ Cause never determined.



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## Environmental hazards California State Univ. Northridge: Earthquake

- Magnitude 6.7
- January 17, 1994 – 4:31 am
- 57 deaths, 11000 injuries

- Epicenter a few km from California State University Northridge campus



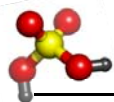
- Several fires in science buildings allowed to burn because firemen worried about chemical hazards

- Professors and students lost equipment, notes, materials, samples

Images courtesy P.W. Weigand, California State University Northridge Geology Department.  
Image source: Earth Science World Image Bank <http://www.earthscienceworld.org/images>

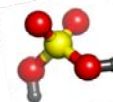


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## Dartmouth College: Dimethylmercury poisoning

- ▶ Karen Wetterhahn, professor and founding director of Dartmouth's Toxic Metals Research Program
  - expert in the mechanisms of metal toxicity
- ▶ In 1996, spilled a few drops of dimethylmercury on her gloved hand
  - Cleaned up spill immediately
  - Latex glove believed protective
- ▶ Six months later, became ill and died of acute mercury poisoning at age 48



## Bhopal: Pesticide plant chemical release

- One of the greatest chemical disasters in history, December 1984
- Union Carbide plant making Sevin released ~40 tonnes of methyl isocyanate in the middle of the night
- Low local demand for pesticides meant the plant was only partially running
- Some hardware was broken or turned off, including safety equipment
  - Safety measures and equipment far below US standards
- Plant in heavily populated area



\* "The Bhopal disaster and its aftermath: a review", Edward Broughton, *Environmental Health: A Global Access Science Source* 2005; 4:6, <http://www.ehjournal.net/content/4/1/6>, accessed 12/07



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## Safety Video: Reactive Hazards



Safety Video

Reactive Hazards:  
Dangers of Uncontrolled  
Chemical Reactions





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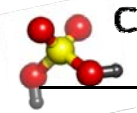


## Taiwan: Silane fire




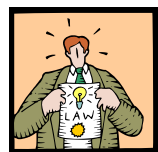


- ▶ Motech Industries solar cell plant in Tainan Industrial Park
  - 1 death
  - US \$1.3 million damage
  - Silane / air explosion
    - Operator responded to gas-cabinet alarm
    - Explosion occurred when he opened gas-cabinet
    - Fire burned for 1 hour before being controlled
      - Caused other  $\text{SiH}_4$  and  $\text{NH}_3$  cylinders to empty
  - November 2005





## Chemical accidents are now under stricter control and scrutiny

- ▶ Better individual country regulations
- ▶ Better international regulations
  - IATA
  - GHS
  - REACH
- ▶ Environmental problems after natural disasters
  - Earthquakes, cyclones, hurricanes, floods
- ▶ Increased public awareness
- ▶ Increased media coverage
- ▶ Less public tolerance

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## Why worry about chemical safety?

- ▶ Health of the workers
- ▶ Safety of the workers
- ▶ Safety of the community
- ▶ Safety of the environment

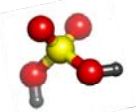



*...It's the right thing to do!*





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## Why worry about chemical security?

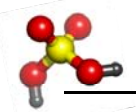
- Long history of people deliberately using chemicals to harm others.
- Information on how to acquire and deliver them is easy to get:



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## Aum Shinrikyo: Matsumoto and Tokyo, Japan

- **Sarin attack on Judges in Matsumoto, June 1994**
  - Sarin sprayed from truck at night
  - 7 deaths, 144 injuries
- **Sarin attack on Tokyo subway, March 1995**
  - 11 bags with 600 g each on 3 main subway lines
  - 12 deaths, 3938 injuries
- **Hydrogen cyanide attacks on Tokyo subway, May 1995**
  - Bags of NaCN and sulfuric acid
  - No deaths, 4 injuries




Photo: reposted poster from Wikipedia.com

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## Aum Shinrikyo: Tokyo, Japan



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## Aum Shinrikyo: Matsumoto and Tokyo, Japan, cont'd.

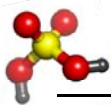
- Recruited young scientists from top Japanese universities.
- Produced sarin, tabun, soman, VX.
- Purchased tons of chemicals through cult-owned companies.
- Motives: proof of religious prophecy, kill opponents, interfere with legal proceedings and police investigations.



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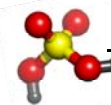


## Chicago, Illinois, USA

- ▶ March 2002, an anarchist (called himself "Dr. Chaos") was found at 2 am in a Univ. Illinois, Chicago, building carrying sodium cyanide
- ▶ Had chemicals in a storage room at the Chicago subway
  - included containers marked mercuric sulfate, sodium cyanide, potassium cyanide, and potassium chlorate
  - 0.25 pound of potassium cyanide and 0.9 pound of sodium cyanide
  - stolen from an abandoned warehouse, owned by a Chicago-based chemical company
    - 15 drums and 300 jars of various other laboratory chemicals were discovered there
- ▶ Sentenced to prison for "possessing a chemical weapon", as well as other charges (Interfering with power, air-traffic control systems, computer systems, broadcast systems and setting fires).



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## Iraq



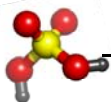
- Many incidents in which chlorine gas cylinders are blown up with explosives
  - Chlorine probably stolen/diverted from water purification plants or oil industry
  - Many civilians and non-combatants injured
- Chlorine first used in WWI as a chemical weapon

On March 23, 2007, police in Ramadi's Jazeera district seized a truck filled with "five 1000-gallon barrels filled with chlorine and more than two tons of explosives"

From: [http://www.longwarjournal.org/archives/2007/03/aI\\_qaedas\\_chlorine\\_w.php](http://www.longwarjournal.org/archives/2007/03/aI_qaedas_chlorine_w.php) downloaded Jan 2008.



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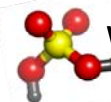
## Chemical Security

**US Homeland Security Secretary Michael Chertoff told the American Chemistry Council, March 21, 2006:**

"Now, the chemical sector certainly stands as one of the principal areas of infrastructure about which we have to be concerned. If you look back at the whole history of the way al Qaeda has conducted its operations, where possible, they have always tried to leverage our own technology against ourselves. They've turned jets, commercial jets, into weapons. They've tried to use our own chemicals and our own products as means of exploding devices against us. And obviously, one of the areas we have to be concerned about are parts of our infrastructure which house chemicals which could, if properly ignited, create a huge amount of havoc in a populated area - whether it be because of a large explosion or whether it's because of toxic inhalation..."



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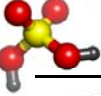


## Why worry about chemical security?

- Health and safety of people and environment
- Community relationships
- Reduce chance of accidental chemical release
- Avoid loss and damage to labs and equipment
- Prevent criminals and terrorists from getting dangerous chemicals
  - Wide variety of chemicals have been used
  - Wide variety of motivations for actions
- A deliberate attack on a chemical facility could release a large amount of hazardous chemicals
  - Injure or kill people in nearby areas
  - Eliminate jobs and economic assets



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## Safety and Security Issues are similar


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### Variables

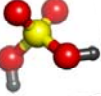
- ▶ Many different chemicals with:
  - different properties
  - different hazard
  - different applications
- ▶ Many different ways to misuse chemicals
  - chemical weapons
  - poisons

### Protect

- ▶ Workers
- ▶ Facility
- ▶ Community
- ▶ Environment







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## Government regulations: Chemical security

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- Differ from country to country
- Legislation needed to fulfill requirements under the Chemical Weapons Convention
  - Each country passes appropriate laws
  - Each country must declare and track certain chemicals
- UN Resolution 1540
- Other export control legislation


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## Important Questions:

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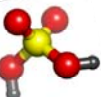
How does your country **regulate** and **control** chemical safety and security?

...Is it effective?



...Could it be improved?

...How?


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# Tea Break

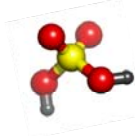



# Fundamentals of Chemical Laboratory Safety

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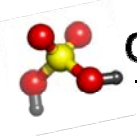


# Definitions

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## Chemical Laboratory Safety

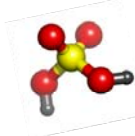
- *The control of exposure to potentially hazardous substances to attain an acceptably low risk of exposure*



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## Chemical Laboratory Safety

**Hazard – *the potential to harm***



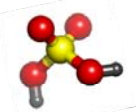
**Risk – *the probability that harm will result***

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## Chemical Laboratory Hazards

- **Chemical hazards**
  - dusts, fumes, mists, vapors, gases
- **Physical hazards**
  - fire, electrical, radiation, pressure vibration, temperatures, noise
- **Ergonomic hazards**
  - repetitive motion (pipetting), lifting, work areas (computers, instruments)
- **Biological hazards**
  - pathogens, blood or body fluids



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## Chemical Laboratory Safety

based on the principle of

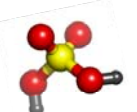
### Industrial Hygiene

– The *anticipation, recognition, evaluation and control* of health hazards in the work environment to protect workers health and well-being and to safeguard the community and the environment

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## Chemical Laboratory Safety

↓

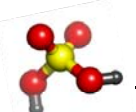
### Industrial Hygiene Principles

Anticipation	}	Chemical hazards
Recognition		Physical hazards
Evaluation		Ergonomic hazards
Control		Biological hazards

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## Anticipation

*Safety First !*

To consider safety in the beginning is:




Easier,

Cheaper,

Safer,

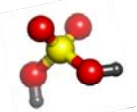
... and it saves you time !



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## Anticipation

Advance Experiment Planning:

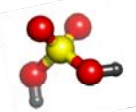


- Outline proposed experiment
- Acquire safety information (M)SDS, REACH
- Consult with CSSO?

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## Anticipation

Risk Analysis

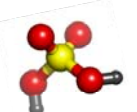


- Which chemicals?
- How much?
- Special equipment needed?
- Who does the work?
- Staff properly trained?
- Can the experiment go wrong?
- Do you have an emergency plan?





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## Recognition

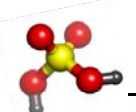
Types of lab hazards:

- chemical toxicity
- fire / explosion
- physical hazards
- biohazards
- radiation
- special substances

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## Recognition & Evaluation

What are the anticipated risks?

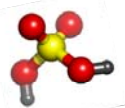
- Are the equipment & facilities adequate?
- Are staff properly and sufficiently trained?
- Risks if experiment goes wrong?
- Is there a plan for this?



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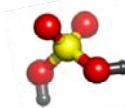
## Control

How are the risks controlled?

- **Engineering controls:**
  - enclosure / isolation
  - ventilation / hoods
- **Emergency Plan**
- **Personal Protective Equipment (PPE)**



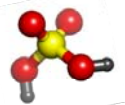
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## Recognition of Chemistry Laboratory Hazards



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## Chemical Toxicity

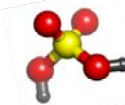


Acute (short term, poisons, asthmagens)  
cyanide  
strychnine

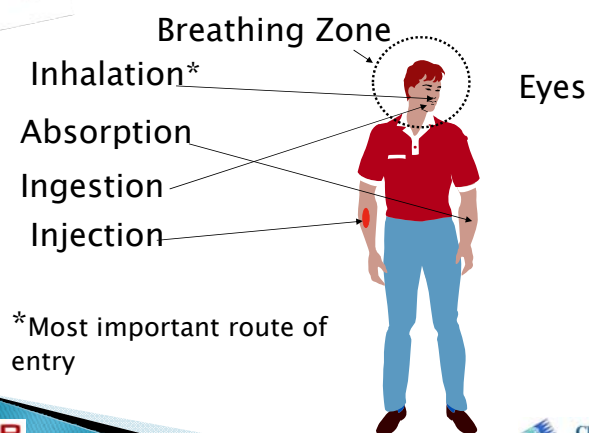
Chronic (long term, carcinogens, reproductive)  
vinyl chloride (liver cancer)  
asbestos (mesothelioma, lung cancer)  
thalidomide (developmental birth defects)



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## Routes of Exposure



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## Fire and Explosion Hazards



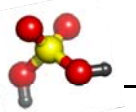









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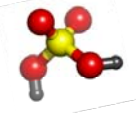


## Physical and Ergonomic Hazards



- ▶ Moving unguarded parts, pinches
- ▶ vacuum pump belts
- ▶ Broken glassware and sharps, cuts
- ▶ Pressure apparatus
- ▶ Vacuum containers
- ▶ Dewar flasks
- ▶ High voltage equipment
- ▶ Computer workstations
- ▶ Slips, trips & falls


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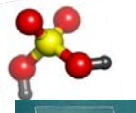

## Biohazards





- ❑ Blood borne pathogens  
AIDS, HIV, hepatitis, clinical chemistry labs
- ❑ Recombinant DNA  
Genetic engineering, cloning
- ❑ Work with animals  
Zoonoses, diseases from animals


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## Radiation Hazards






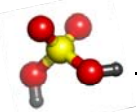


**Ionizing Radiation:**  
alpha  $\alpha$ , beta  $\beta$ , gamma  $\gamma$ ,  
X-rays, neutrons


**Radioactive isotopes:**  
tritium, H-3, carbon, C-14,  
sulfur, S-35, phosphorus, P-32/33, iodine, I-135






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## Radiation Hazards



Non-Ionizing Radiation:  
 Ultraviolet (UV spectrometers)  
 Magnetic (NMR, MRI)  
 Microwave  
 (Heart pacemaker hazard)  
 Lasers  
 (eye protection required)

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## Special Chemical Substances

Controlled Substances:  
 regulated drugs, psychotropic  
 (hallucinogenic) substances, heroin



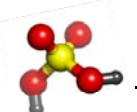
Highly Toxic Chemicals:  
 nerve gas, phosgene, riot control  
 agents, chemical warfare agents



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## Evaluation & Control

- Administrative practices  
organizational policies
- Operational practices  
work practices
- Engineering controls  
ventilation, barriers



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### Administrative & Operational Practices and Engineered Controls

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## Administrative Practices

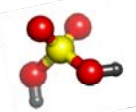


organizational *safety policies*  
that apply to everyone

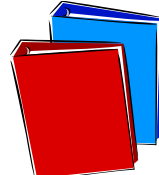
**CSP**  
CHEMICAL SECURITY  
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Chemical  
SAFETY AND SECURITY TRAINING

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## Lab Safety Policies

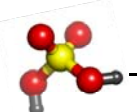


- ❖ Have a Safety Manual
  - Never work alone, especially after hours.
  - Specify when eye protection & PPE is required.
  - Specify operations that require hood use.
  - Specify required training.
  - No mouth pipetting.
  - No long hair or dangling attire.

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## Lab Safety Policies

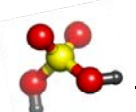
- ▶ No eating, drinking, smoking in laboratories
- ▶ Label all chemical containers
- ▶ Label refrigerators, No Food
- ▶ Label explosion safe refrigerators
- ▶ Require periodic fire drills



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## Operational Practices

### Safe Laboratory Procedures:

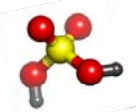
- ▶ Packages opened only in labs, not receiving
- ▶ Receiving staff trained to look for signs of breakage and/or leaking shipments
- ▶ Receiving area has spill kits
- ▶ Mailroom/receiving alert for suspicious shipments




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## Safe Laboratory Procedures



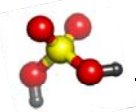
Use hoods properly:

- Work 6" (15 cm) in from sash
- In center of hood
- Work with hood sash at ~18" (45 cm) high
- Close sash when not in use
- Don't use for storage

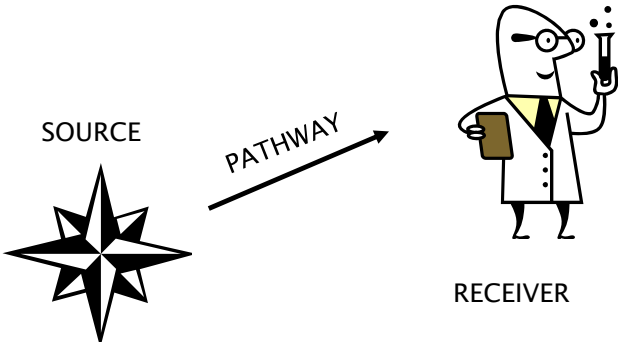
**CSP** CHEMICAL SECURITY PROGRAM

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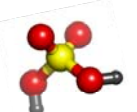
## Engineering Controls



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## Engineering Controls

1. Change the process  
eliminate the hazard



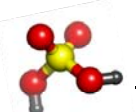
2. Substitution  
non-hazardous substance for hazardous  
(e.g. – toluene for benzene)



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## Engineering Controls

3. Isolate or enclose the process or worker  
Use a barrier



4. Ventilation

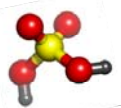


Dilution (general ventilation) – Not good  
Local exhaust ventilation (LEV) – Preferred

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## Engineering Controls

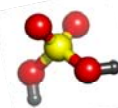


Properly functioning  
& used correctly!

Laboratory hoods and  
ventilation are the basis  
of engineering controls.



61

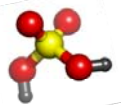


## Laboratory Hoods

Must be used and maintained properly.



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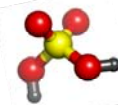


## Engineering Controls

Local exhaust  
ventilation  
includes:  
*snorkels*



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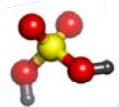
## Engineering Controls

Local exhaust ventilation includes:  
*vented enclosures*



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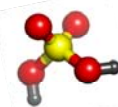
## Engineering Controls



Local exhaust includes:  
*special containment devices*  
(e.g. – glove boxes)



65



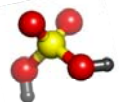
## Engineering Controls



Local exhaust includes:  
*special containment devices*  
(e.g. – isolation chambers)



66

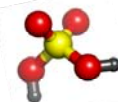


## Engineering Controls

Hood exhaust should not be blocked or deflected downward, but should exhaust straight up



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## Personal Protective Equipment

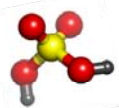


PPE includes:  
eye protection,  
gloves,  
laboratory coats, etc.,  
respirators,  
appropriate foot protection



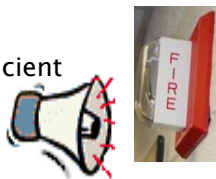
68



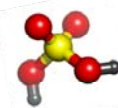


## Emergency Planning & Response

- Have routine, unannounced evacuation drills.
- Designate a person for each area to ensure that inner rooms are evacuated.
- Locate outside staging areas at sufficient distance from the building.
- Test and maintain alarms.
- Post a person to meet/direct emergency vehicles.



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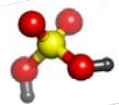


## Emergency Planning & Response

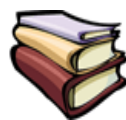
Post each room with:  
Emergency phone numbers  
After hour phone numbers  
Person(s) to be contacted  
Alternate person(s)  
Unique procedures to be followed



70



## References



"Safety in Academic Laboratories, Vol.1 & 2," American Chemical Society, Washington DC, 2003, also available online:

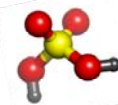
[http://portal.acs.org/portal/acs/corg/content?\\_nfpb=true&\\_pageLabel=PP\\_SUPERARTICLE&node\\_id=2230&use\\_sec=false&sec\\_url\\_var=region1&\\_\\_uuid=ef91c89e-8b83-43e6-bcd0-ff5b9ca0ca33](http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_SUPERARTICLE&node_id=2230&use_sec=false&sec_url_var=region1&__uuid=ef91c89e-8b83-43e6-bcd0-ff5b9ca0ca33)

"Prudent Practices in the Laboratory: Handling and Disposal of Chemicals," National Academy Press, 1995, also available online:

[http://www.nap.edu/catalog.php?record\\_id=4911](http://www.nap.edu/catalog.php?record_id=4911)



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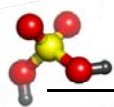
## Aspects of Chemical Security



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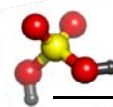


## Chemical Security Questions

- Is your facility secure?
- How easy would it be for someone to steal chemicals?
- Are the chemistry workrooms, stockrooms, classrooms and labs always locked and secure?
- Is someone always there when these rooms are open?
- Do you check your orders when chemicals arrive to be sure some chemicals are not missing?



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## Components of Chemical Security

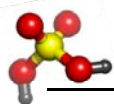
- Physical security of site
- Personnel management
- Information security
- Management of chemical security activities
- Allocation of chemical security responsibilities
- Development of emergency plans
- Chemical security training



**Goal: Ensure that you don't accidentally help a criminal or a terrorist get dangerous chemicals**



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## Chemical Security: Physical Site



**LOCK UP!!**

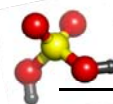
Controlled drugs

Chemical Surety Agents

Highly toxic chemicals



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## Facility Characterization



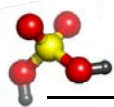
**Characterize the facility in terms of:**

- |   |  |
|---|--|
| - Site boundary                             | - Operating conditions (working hours, off-hours, potential emergencies) |
| - Buildings (construction and HVAC systems) | - Safety considerations  |
| - Room locations                            | - Types and numbers of employees   |
| - Access points                             | - Legal and regulatory issues  |
| - Processes within the facility             |  |
| - Existing Protection Systems               |  |



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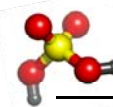
## Facility Characterization

Facility characterization provides important data that:

- Identifies locations and assets to be protected
- Establish what existing Protection System components are already present at the facility
- Documents facility layout for use in analysis



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## Threat Definition

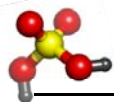
Threat classes:



- Outsiders—no authorized access
- Insiders—authorized access
- Collusion—between Outsiders and Insiders

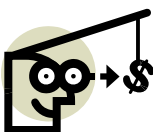


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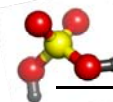
## What Might Motivate Adversaries?

- |                     |                   |
|---------------------|-------------------|
| • <b>Terrorists</b> | • <b>Insiders</b> |
| - Ideology          | - Ego             |
| • <b>Criminals</b>  | - Ideology        |
| - Financial         | - Revenge         |
| • <b>Activists</b>  | - Financial       |
| - Ideology          | - Coercion        |



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## Target Identification

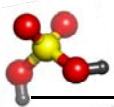
- Determine possible targets for:
  - Sabotage
    - Identify vital areas to protect
  - Theft of chemicals
  - Theft of information
    - Identify location of materials to protect



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80



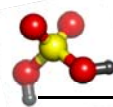


## Chemical Security: Personnel Management

- Guard against both *Insider and Outsider* threat
- Who checks people entering the building?
- Who has keys? How do they get authorized?
  - Building
  - Stockroom
  - Individual Labs
- When someone leaves, do you make sure they turn in keys?
  - Don't want people making duplicate keys



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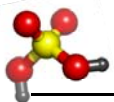


## Chemical Security: Information Security

- How do you track chemical inventory?
  - Is the information secured so unauthorized people can't read it or alter it?
- Would you know if:
  - some toxic chemicals disappeared overnight?
  - some toxic chemicals didn't arrive?
  - someone was ordered chemicals in the name of your institution but diverted them?



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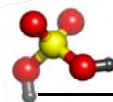


## Chemical Security: Assign Responsibilities

- Identify people responsible for various chemical security activities:
  - Physical security, building modifications
  - Chemical tracking and reporting
  - Personnel and access management
  - Information management
  - Emergency planning
- Ensure they have the time and resources to do the job.
- Integrate with chemical safety responsibilities.



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## Chemical Security: Professional Behavior

- Chemical professionals use their scientific knowledge in a responsible manner.

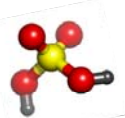


- Chemical Educators need to train their students to use their scientific knowledge in a responsible manner.



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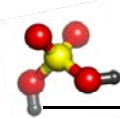


## Relationships between Chemical Security and Chemical Safety



85

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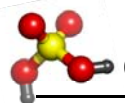
## Relationships Between Chemical Safety and Security

- **Chemical safety:** Protect against accidents
- **Chemical security:** Protect against deliberate harm

Many practices are the same for chemical safety and security, but there are a few areas of conflict.



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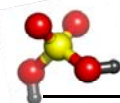


## Good Practices for Both Chemical Safety and Security

- **Minimize use of hazardous chemicals.**
  - Replace with less-hazardous chemicals, if possible.
  - Reduce scale of experiments.
- **Minimize supply of hazardous chemicals.**
- **Restrict access to hazardous chemicals.**
  - Know what you have.
  - Know how to store, handle and dispose of what you have.
  - Know who has access to materials, knowledge and expertise.
- **Plan what to do in an emergency.**



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## Conflicts Between Chemical Safety and Security: Information Sharing

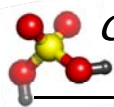
Science generally means sharing information widely, but this may not always be advisable.

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>• <b>Safety</b> <ul style="list-style-type: none"> <li>– Label everything so people can recognize hazardous chemicals.</li> <li>– Let community and especially emergency responders know what chemical dangers are there.</li> <li>– Share knowledge about chemical hazards so people know to be alert.</li> </ul> </li> </ul> | <ul style="list-style-type: none"> <li>• <b>Security</b> <ul style="list-style-type: none"> <li>– Labels help identify targets for theft or attack.</li> <li>– Sharing locations of chemicals can publicize targets for theft or attack.</li> <li>– Sharing knowledge of chemical hazards could inspire harmful behavior (copy-cat criminals).</li> </ul> </li> </ul> |
|---|---|



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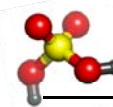
## Conflicts Between Chemical Safety and Security: Facility Exits

Locking exit doors is secure, but not safe.

- For **safety**, people need to be able to leave the facility quickly and by many routes.
- For **security**, you want to control exits as well as entrances so chemicals (or equipment) are not taken.



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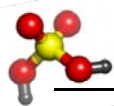


## Setting Priorities

- Labs need to be **safe**, **secure** and **productive**.
  - Policies and practices need to be flexible enough to allow for the uncertainties of research.
  - Policies and practices need to align with local laws, regulations, practices and culture. Can't just copy from somewhere else.
- Use **risk-based security and safety measures**.
  - Can't afford to defend against every imaginable hazard.
  - Identify threats, characterize facilities, identify alternatives, analyze costs vs. performance.
- Be alert** for suspicious activities or inquiries.



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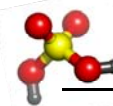
## All Chemical Facilities Need to be Secured



- Small-scale research laboratories
  - Many different chemicals used in small amounts.
- Large-scale manufacturing plants
  - Limited types of chemicals used in large amounts.
- Security measures need to match facility and threat
  - Can't afford to defend against all imaginable threat.



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## Group Discussion

- What chemicals are of most concern for diversion?

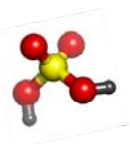
- Common laboratory/industrial chemicals that would be targeted by someone for illegal reasons such as making explosives, illegal drugs, or chemical weapons.



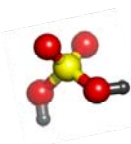
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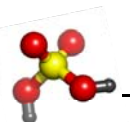
# Lunch



# Dual-use Chemicals Awareness



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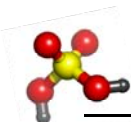


## Chemical dual-use awareness

Dual use chemicals: Chemicals used in industry or everyday life that can also be used in bad ways.

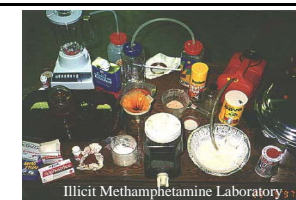


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## Dual-use chemical example: Pseudoephedrine

- ▶ Pseudoephedrine is a common ingredient in cold medicines
- ▶ Precursor to crystal methamphetamine
- ▶ Recipes for conversion available on web



Illicit Methamphetamine Laboratory



- Clandestine meth labs in US during 2002
  - Caused 194 fires, 117 explosions, and 22 deaths
  - Cost \$23.8 million for cleanup
  - Dumped chemicals led to
    - deaths of livestock
    - contaminated streams
    - large areas of dead trees & vegetation

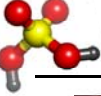

US DEA, [http://www.deadiversion.usdoj.gov/pubs/brochures/pseudo/pseudo\\_trifold.htm](http://www.deadiversion.usdoj.gov/pubs/brochures/pseudo/pseudo_trifold.htm), viewed Dec 2007




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## Dual-use chemical example: Cyanide






Therence Koh/AFP/Getty Images



- ▶ Widely used in mining and metal plating industries, but is also a well known poison.
- ▶ Product tampering\*
  - Tylenol capsules
    - laced with KCN
    - 7 deaths, fall 1982, Chicago, Illinois, USA
    - Led to tamper-proof product packaging
- ▶ Popular with criminals and terrorists because it is relatively easy to obtain
- ▶ HCN is CW agent AC

\* "Tylenol Crisis of 1982." Wikipedia, The Free Encyclopedia. 22 Nov 2007, 06:04 UTC. Wikimedia Foundation, Inc. 28 Nov 2007 <[http://en.wikipedia.org/w/index.php?title=Tylenol\\_Crisis\\_of\\_1982&oldid=173056508](http://en.wikipedia.org/w/index.php?title=Tylenol_Crisis_of_1982&oldid=173056508)>.

## Dual-use chemical example: Pesticides

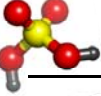






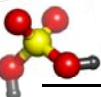
FIGURE. Package of Chinese rodenticide implicated in the poisoning of a Chinese infant aged 15 months — New York City, 2002  
Photo/New York City Poison Control Center




- ▶ Widely used in homes and agriculture, but also used to poison people.
- ▶ **Dushuqiang (Strong Rat Poison)**
  - Outlawed in China in the mid-1980s, but was still available
  - Nanjing, China, Sept. 2002
    - 38 people killed by poison in snack-shop food, >300 sick
    - Jealously by rival shop owner
  - Hunan, China, Sept. 2003
    - 241 people poisoned by cakes served by school cafeteria
    - Motive and perpetrator unknown
  - Tongchuan City, Shaanxi, China, April 2004
    - 74 people poisoned by scallion pancakes
    - Motive and perpetrator unknown
  - 5 other incidents reported between 1991 and 2004

Ann. Emerg. Med., Vol. 45, pg. 609, June 2005



## Many lab/industrial chemicals have dual uses



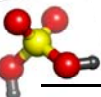
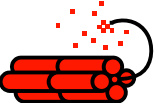




- ▶ **Dimethyl methyl phosphonate (DMMP)**
  - Flame retardant for:
    - building materials, furnishings, transportation equipment, electrical industry, upholstery
  - Nerve agent precursor
- ▶ **Thiodiglycol**
  - Dye carrier, ink solvent, lubricant, cosmetics, anti-arthritis drugs, plastics, stabilizers, antioxidants, photographic, copying, antistatic agent, epoxides, coatings, metal plating
  - Mustard gas precursor
- ▶ **Arsenic Trichloride**
  - Catalyst in CFC manufacture, semiconductor precursor, intermediate for pharmaceuticals, insecticides
  - Lewisite precursor


From: Chemical Weapons Convention: Implementation Assistance Programme Manual (on CD)






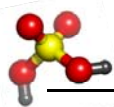
## Dual-use Chemicals: Explosives

- ▶ Theft of conventional explosives
  - Chemical suppliers
  - Users such as mines or construction sites
- ▶ Diversion of industrial or laboratory chemicals
  - Chemical suppliers
  - Chemical factories
  - Academic teaching or research laboratories
  - Disposal sites





## Theft / manufacture of explosives: Fertilizer Bomb

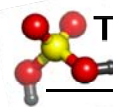


Photo: US DOD

- ▶ Ammonium nitrate fertilizer and fuel oil (diesel, kerosene)
- ▶ Used to bomb Alfred P. Murrah building in Oklahoma City, OK, USA
  - with nitromethane and commercial explosives
  - 168 dead, including children
  - April 1995
- ▶ Favored by IRA, FARC, ETA, etc.

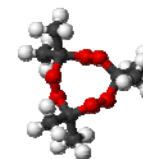


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## Theft / manufacture of explosives: TATP

- ▶ Triacetone triperoxide (TATP)
- ▶ Invisible to detectors looking for N-based explosives
- ▶ Made using acetone, hydrogen peroxide, strong acid (HCl, sulfuric)
- ▶ Favored by terrorists "Mother of Satan"
  - Sept 2009 arrest of N. Zazi, NY and Denver
  - July 2005 London suicide bombs
  - 2001 Richard Reid "shoe bomber"
  - 1997 New York subway suicide bomb plot



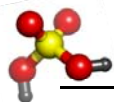
CAS 17088-37-8

Wikipedia downloaded Oct 2009

[http://en.wikipedia.org/wiki/Acetone\\_peroxide](http://en.wikipedia.org/wiki/Acetone_peroxide)



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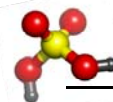
## Diversion of industrial / laboratory chemicals: Sodium azide



- ▶ Widely available from older automobile airbags
  - 1980s to 1990s
- ▶ Poisonous
- ▶ Reacts explosively with metals
  - Biological laboratory drains have exploded from discarded waste solutions containing  $\text{NaN}_3$  as a preservative.
- ▶ Has been found in possession of terrorists



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## Diversion of industrial / laboratory chemicals: Bali bombing

- ▶ Amrozi purchased chemicals used to make bombs
- ▶ One ton of potassium chlorate\* purchased in three transactions from the Toko Tidar Kimia fertilizer and industrial chemicals store in Jalan Tidar, Surabaya, owned by Sylvester Tendean.
  - Claimed he was a chemical salesman.
  - Obtained a false receipt saying he purchased sodium benzoate.
  - Tendean lacked proper permit to sell this chemical, didn't know the chemical would be used for a bomb.
- ▶ Details of Aluminum powder purchases not known

\* Some press reports state potassium chloride, but this is clearly an error

<http://www.smh.com.au/articles/2003/06/09/1055010930128.html>  
<http://www.thejakartapost.com/news/2002/12/18/amrozi-owns-possession-chemicals.html>



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## International Chemical Controls

**CSP**  
CHEMICAL SECURITY  
EMPLOYMENT PROGRAM

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**Chemical**  
SAFETY AND SECURITY TRAINING



## International chemical control groups

 **ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS**

Chemical weapons convention

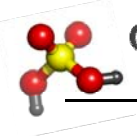
**The Australia Group**  
Export controls

**UN Security Council Resolution 1540**

**CSP**  
CHEMICAL SECURITY  
EMPLOYMENT PROGRAM



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**Chemical**  
SAFETY AND SECURITY TRAINING



## Organization for the prohibition of chemical weapons (OPCW)

- ▶ International group headquartered in The Hague, Netherlands
  - <https://www.opcw.org/index.html>
- ▶ Chemical weapons convention (CWC)
  - International treaty which bans the development, production, stockpiling, transfer and use of chemical weapons
- ▶ Promotes international cooperation in peaceful uses of chemistry
- ▶ Protecting each other

**CSP**  
CHEMICAL SECURITY  
EMPLOYMENT PROGRAM

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**Chemical**  
SAFETY AND SECURITY TRAINING



## Chemical Weapons Convention (CWC)

- ▶ International treaty which bans the development, production, stockpiling, transfer and use of chemical weapons
  - Entered into force in April 1997 with 87 State Parties participating
  - Today: 183 nations have joined, 5 others have signed, only 7 have not taken any action.
    - Each nation enacts appropriate laws
    - Each nation agrees to assist other Member States




**CSP**  
CHEMICAL SECURITY  
EMPLOYMENT PROGRAM

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**Chemical**  
SAFETY AND SECURITY TRAINING





## CWC: Destroy existing stockpiles and facilities



- ▶ Twelve States parties have declared CW production facilities.
  - Bosnia and Herzegovina
  - China
  - France
  - India
  - Islamic Republic of Iran
  - Japan
  - Libyan Arab Jamahiriya
  - Russian Federation
  - Serbia
  - United Kingdom of Great Britain and Northern Ireland
  - United States of America
  - another State Party
- ▶ As of August 2007, 42 of 65 declared CW production facilities have been certified as destroyed, 19 converted to peaceful purposes.
- ▶ As of August 2007, 23,912 metric tonnes of CW agent has been destroyed out of 71,330 metric tonnes declared.
- ▶ On 11 July 2007, the OPCW confirmed the destruction of the entire chemical weapons stockpile in Albania.
- ▶ Includes old and abandoned CW munitions



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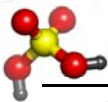

## CWC: Prevent spread or production of new chemical weapons

- ▶ States declare and agree to inspections of many chemical facilities,
- ▶ Over 3,000 inspections have taken place at 200 chemical weapon-related, and over 850 industrial sites of 79 States Parties since April 1997
- ▶ Worldwide, over 5,000 industrial facilities are liable to inspection









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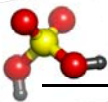
## CWC: Chemicals on schedules subject to verification measures



- ▶ **Schedule 1:**
  - Known CW agents
  - Highly toxic, closely related chemicals, or CWA precursors
  - Has little or no peaceful application
- ▶ **Schedule 2:**
  - Toxic enough to be used as a CWA
  - Precursor to or important for making a Schedule 1 chemical
  - Not made in large commercial quantities for peaceful purposes
- ▶ **Schedule 3:**
  - Has been used as a CWA
  - Precursor to, or important for making a Schedule 1 or 2 chemical
  - Is made in large commercial quantities for peaceful purposes
- ▶ Unscheduled Discrete Organic Chemicals (UDOC)
- ▶ Lists of scheduled chemicals follow: also in documents on CD





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## CWC: Reporting requirements


- ▶ Use/transfer of these chemicals is allowed for research, medical, or pharmaceutical purposes.
- ▶ Reporting requirements depend on facility type, chemical types and amounts.
  - "Other Facility" type, as defined in CWC documents, most relevant here
  - Amounts of chemicals that would require that your National Authority approve the work and report your institution annually to the OPCW
    - Schedule 1: 100 g aggregate
    - Schedule 2: 1 kg for 2A\*, 100 kg for other 2A, 1 Tonne of 2B
    - Schedule 3: 30 Tonnes
    - UDOC: 30 or 200 Tonnes (lower number if contains P, S, or F)



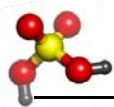
**Caution:**  
Your country might require reporting of lower amounts!



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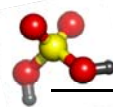


## OPCW: international cooperation in peaceful uses of chemistry

- ▶ Associates program
- ▶ Analytical skills development course
- ▶ Conference support program
- ▶ Research projects program
- ▶ Internship Support Program
- ▶ Laboratory Assistance Program
- ▶ Equipment Exchange Program



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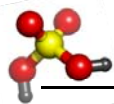


## OPCW: Protecting each other

- ▶ Each member state can request assistance from other member states in the event of a threat or attack, including chemical terrorism
- ▶ This can take the form of expertise, training, materials, and/or equipment



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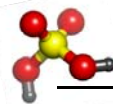


## Australia Group

- ▶ An informal arrangement to minimize the risk of assisting chemical and biological weapon (CBW) proliferation.
- ▶ 40 nations plus European Commission participate
  - Harmonising participating countries' national export licensing measures
  - Started in 1985 when Iraq CW program was found to have diverted chemicals and equipment from legitimate trade



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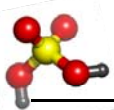
## Australia Group: Export Controls

- ▶ Controls exports of:
  - 63+ Chemical weapon agent precursor chemicals
  - Dual-use chemical manufacturing facilities and equipment and related technology
  - Dual-use biological equipment and related technology
  - Biological agents
  - Plant pathogens
  - Animal pathogens
- ▶ Includes no-undercut policy
  - Countries won't approve an export that another member country denied



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## UN Security Council Resolution 1540

- ▶ Unanimously passed on 28 April 2004
- ▶ Member States:
  - **must refrain from supporting non-State actors** in developing, acquiring, manufacturing, possessing, transporting, transferring or using **nuclear, chemical or biological weapons and their delivery systems**.
  - **must establish domestic controls** to prevent the proliferation of nuclear, chemical and biological weapons, and their means of delivery, including by establishing appropriate controls over related materials.
- ▶ **Enhanced international cooperation** on such efforts is encouraged, in accord with and promoting universal adherence to existing international non-proliferation treaties.



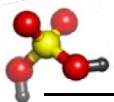
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## REACH and the Global Harmonized System for the Labeling of Chemicals



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## REACH



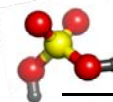
### Registration, Evaluation, Authorization of Chemicals

2007 EU regulation; replaces 40 existing acts to create a single system for all chemicals

- requires authorization to use, manufacture and import
- to track and manage chemical risks and provide safety information
- proposes to integrate REACH with GHS
- creates European Chemical Agency (ECHA, Helsinki, Finland)



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## REACH

### Life of the chemical from Cradle-to-the-Grave



Manufacturing  
Importing  
Marketing  
Use  
Waste stream



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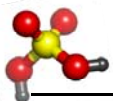
## REACH




- ▶ Comprehensive legislation to ensure European authorities know and condone what chemicals are used as they enter the EU
- ▶ Objective is to protect human health and the environment by recognizing and classifying hazardous chemicals so they are handled safely
- ▶ REACH & GHS are not equivalent or optional but separate legislation with parallel requirements

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## REACH



- ▶ The responsibility for proving whether a chemical is hazardous or non-hazardous is on the manufacturer and supplier not the government
- ▶ The responsibility also includes documentation, tests, classification, risk exposure, labeling, safety data sheets
- ▶ ECHA will store the information in the International Uniform Chemical information Database (IUCLID)

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## REACH

Four Steps:

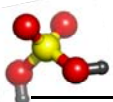
1. Registration
2. Evaluation
3. Authorization
4. Restriction



ECHA maintains database

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## REACH: Registration

**Importers & manufacturers** of substances in quantities over 1 ton/yr must register the substance with ECHA:

**Registration began June 2007**

**December 1, 2010**

- ≥ 1000 tons per year
  - carcinogen, mutagen, or reprotoxin ≥ 1 ton per year
  - substances classified as dangerous for aquatic environment ≥ 100 tons per year



**June 1, 2013**

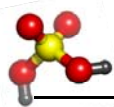
- manufactured or imported at 100-1000 tons per year

**June 1, 2018**

- manufactured or imported at 1-100 tons per year

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## REACH: Evaluation

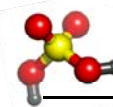
Authorities will review registration and request further information or testing to determine the impact of the substance on human health and the environment

### Decides next steps:

- action for authorization
- align classification & label
- other action



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## REACH: Authorization

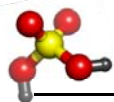
Decisions on what substances require an **authorization or restriction are carried out for substances that pose the most concern**, such as carcinogens and mutagens

### Three steps:

- SVHC (Substances of Very High Concern)
  - carcinogenic, mutagenic and reprotoxic substances, persistent, bio-accumulative and toxic
- Prioritize
- Authorization provided



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## REACH: Restriction

### • Limit uses

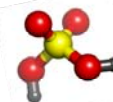
- Where no viable alternative exists, a research and development plan to derive a suitable alternative is developed

### • Ban substance

- where there is an **unacceptable risk** to human health and the environment.



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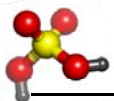
## Globally Harmonized System for Classification and Labeling of Chemicals (GHS)

International UN standardization for classification, safety data sheet format, and labeling of chemicals using pictograms, signal words, and hazard warnings




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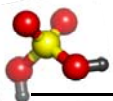
## GHS




- ▶ United Nations **proposed system** to **internationally standardize chemical communication**
- ▶ Countries will **adopt on their own timeframe**
- ▶ **2008** – **UN goal** for world-wide implementation

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## GHS Implementation



**Intergovernmental Forum on Chemical Safety (IFCS)** – adopted GHS implementation goal of 2008. The US participates and agreed to work toward this goal



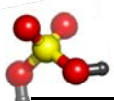
**Japan, Korea, New Zealand** – various stages of adopting & implemented GHS

**European Union** – 2010 deadline for GHS substance classification

**Canada** – Assessing how to adopt and implement GHS



**United States** – OSHA proposed rulemaking at end of 2009. DOT has adopted some parts, working on others.

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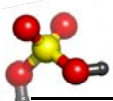




## GHS Benefits

- Uniform Communication
- Better Safety
- Improved International Trade
- Lower cost

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## GHS Changes



MSDS name: now “**SDS**” (**Safety Data Sheet**)

**Labels will be standardized with:**

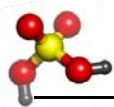
- signal words
- hazard statements
- precautionary statements
- pictograms
- eliminates US, Canadian and EU labels

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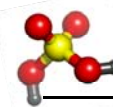
## GHS Labeling

Information required on a GHS label:

- ▶ Pictograms
- ▶ Signal words
- ▶ Hazard statements
- ▶ Precautionary statements and pictograms
- ▶ Product identifier
- ▶ Supplier information



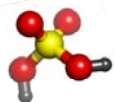
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## Examples: GHS Pictograms



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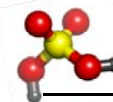


## Differences between REACH and GHS

- ▶ REACH and GHS **have different scopes** but there are many links between the two regulations
- ▶ **REACH aims for** information on hazards, risks, and **risk management**
- ▶ **GHS aims to harmonize classification and labeling** of materials
- ▶ **GHS is a UN recommendation** which applies across countries, including the EU



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## REACH & GHS: Resources

### • About REACH:

- <http://guidance.echa.europa.eu/>
- [http://ec.europa.eu/environment/chemicals/reach/reach\\_intro.htm](http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm)
- [http://echa.europa.eu/help\\_en.asp#helpdesks](http://echa.europa.eu/help_en.asp#helpdesks)
- <http://ec.europa.eu/echa>

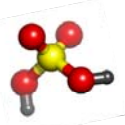
### • GHS Resources:

- [http://www.unece.org/trans/danger/publi/ghs/ghs\\_rev02/02files\\_e.html](http://www.unece.org/trans/danger/publi/ghs/ghs_rev02/02files_e.html)
- [http://www.unece.org/trans/danger/publi/ghs/presentation\\_e.html](http://www.unece.org/trans/danger/publi/ghs/presentation_e.html)
- <http://www.osha.gov/dsg/hazcom/ghs.html>

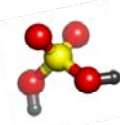


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## Tea Break

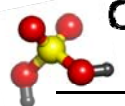


## Chemical Safety and Security Program

### Organization and Responsibilities



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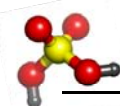


## Chemical Safety and Security Program Purpose

- ▶ Help establish a safe and secure workplace.
- ▶ Help safeguard the environment.
- ▶ Prevent/reduce release of hazardous chemicals and operations.
- ▶ Prevent/reduce exposure to staff.
- ▶ Reduce stress.
- ▶ Enhance community relations.
- ▶ Comply with regulations.
- ▶ Crisis management



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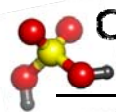
## Crisis Management: Prevention & Response

- Facility crisis
  - Fire
  - Explosion
  - Chemical release
- Natural disaster
  - Earthquakes
  - Hurricane/typhoon
  - Tsunami
- Disgruntled personnel
  - Employees
  - Ex-workers
  - Students
- Demonstrations, protests
- Evacuation/reoccupancy
- Terrorism



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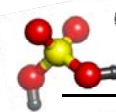


## Crisis Management: Criminal & Terrorism Concerns

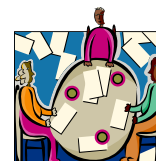
- External security
  - Fences
  - Cameras
  - Guards
- Internal security
  - Personnel background checks
  - Employees, contractors, students
- ▶ Theft
  - Chemicals, materials
  - Equipment
- ▶ Bombing
- ▶ Toxic release



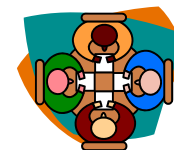
141



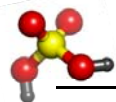
## Chemical Safety and Security Applies to Everyone



Administration  
Human Resources  
Purchasing  
Facilities  
Construction  
Police/Security  
Department Administration  
Research Administration  
Employees  
Students  
Contractors  
A//visitors



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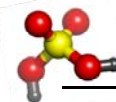


## Faculty/Principal Investigator

has the responsibility  
to *teach, model* and *encourage*  
good Chemical Safety and  
Security practices



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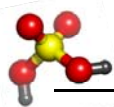
## Principal Investigator CSS Responsibilities

- ▶ Develop procedures with CSSO for unique hazards and chemicals (e.g. carcinogens)
- ▶ Develop proper control practices with CSSO
- ▶ Participate in developing CSS Plan, CSS Committee, accident investigations
- ▶ Ensure CSS documents and records are maintained
- ▶ Maintain local chemical inventory for their lab
- ▶ Ensure (M)SDS are available in the laboratory
- ▶ Facilitate compliance with policies, guidelines and regulations



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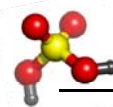


## CSS Responsibilities Principal Investigator

- ▶ Ensure students/workers know and follow policies and practices
- ▶ Ensure equipment and controls are properly maintained
- ▶ Ensure all students/workers received proper training and refreshers
- ▶ Ensure new students/workers receive proper training before starting work
- ▶ Inform CSSO of any accidents and incidents
- ▶ Follow-up on accidents and incidents



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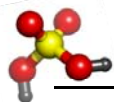


## Employees and students

have a responsibility  
to *actively* support and participate  
in the CSS Program.



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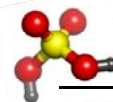


## Employee/Student CSS Responsibilities

- ▶ Follow policies/rules
- ▶ Wear Personal Protective Equipment (PPE)
- ▶ Report accidents, incidents/near misses, problems
- ▶ Learn about hazards of specific chemicals
- ▶ Suggest changes and improvements
- ▶ Encourage good safety and security
- ▶ Work safely
- ▶ Do not put others at risk
- ▶ Behave responsibly



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## Chemical Safety and Security Officer

has the responsibility to:

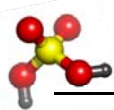
*provide expertise and  
information*

so that a safe and healthy  
workplace is present



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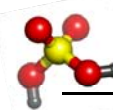
## Chemical Safety and Security Committee

has the responsibility to:

*oversee and monitor the CSS Program*  
for management so that  
a safe and healthy workplace  
is maintained



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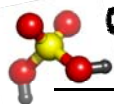


## Chemical Safety and Security Committee Responsibilities

- ▶ Reports directly to senior management
- ▶ Endorses policies
- ▶ Meets regularly (2 – 4 times/yr) with agendas
- ▶ Reviews accidents and incidents, may investigate, write reports with recommendations
- ▶ Establishes appropriate subcommittees on specific topics



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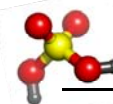


## Chemical Safety and Security Committee Composition

- ▶ Chaired by committed staff
- ▶ CSSO is ex-officio member
- ▶ Includes representatives from:
  - Facilities Management
  - Security
  - Administration
  - Faculty/Staff
  - Teaching Assistants/Graduate Students
  - Shops/Unions
- ▶ Representatives should rotate after a few years



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## Management CSS Responsibilities

### Commitment:

- ▶ Establish a formal CSS Program
- ▶ Announce formation of a CSS Program
- ▶ Create a written policy statement
- ▶ Designate a Chemical Safety and Security Officer
- ▶ Endorse a written CSS Plan (Manual)
- ▶ Participate and intervene as needed

### Support:

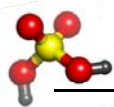
- ▶ Financial support (budget)
- ▶ Staffing
- ▶ Response/resolution of problems by
  - Establishing a CSS Committee
- ▶ Stipulates CSS is part of everyone's job
  - CSS applies to everyone
  - Specifies CSS orientation for new employees
- ▶ Supports CSS staff



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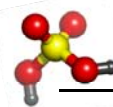
## Management CSS Responsibilities

### POLICY STATEMENT

Documents and describes  
the commitment and support  
from the highest management level  
for the Chemical Safety and Security Program



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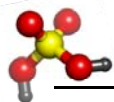
## Policy Statement Purpose

Establish and provide for maintenance of an  
effective Chemical Safety and Security  
Program to protect:

- Employees
- Facility
- Neighbors
- Environment
- Comply with regulations



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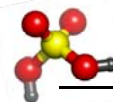


## Policy Statements

- ▶ By senior management
- ▶ Typically brief
- ▶ Clear goals
- ▶ Commitment
- ▶ Defines employee role
- ▶ Identifies resources and staff
- ▶ Signed by person in authority



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## Director/President CSS Responsibilities

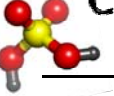
- ▶ Establish an effective CSS Program
- ▶ Provide for a budget
- ▶ Endorse written Policies, Plans and Manuals
- ▶ Appoint CSS Officers
- ▶ Ensure CSSO has responsibility, authority and accountability to perform assigned duties
- ▶ Establish a CSS Committee
- ▶ Maintain support and endorsement
- ▶ Timely response to Safety Committee recommendations
- ▶ Follow and set example, e.g., wears PPE



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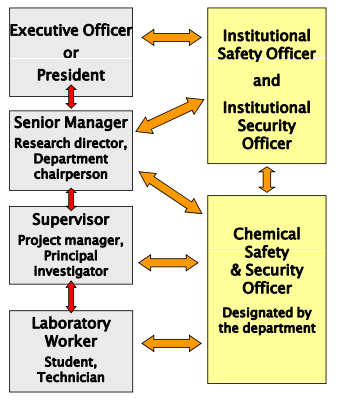


## Chemical Safety and Security Program Ideal Roles



- ▶ Culture of Chemical Safety and Security should exist at all levels of the organization.
- ▶ Top management sets policy, provides resources.
- ▶ Workers, students, researchers must understand and implement.
- ▶ Many organizational interactions are important for chemical safety and security

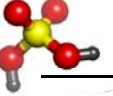
• After Fig 1-1 in Prudent Practices in the Laboratory, NRC 1995




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**CSP** CHEMICAL SECURITY PROGRAM  
Chemical SAFETY AND SECURITY TRAINING

## CSS Program Evaluation



- ▶ Management leadership
- ▶ Employee involvement
- ▶ Administrative controls
- ▶ Security controls
  - Access to buildings, materials
- ▶ Engineering controls
- ▶ Accident/incident investigation
- ▶ Training
- ▶ Use of Personal Protective Equipment (PPE)
- ▶ Emergency Response Program
- ▶ Medical Surveillance Program
- ▶ Work site analysis
  - Inspections, surveys, hazard analysis



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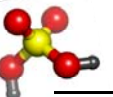
**CSP** CHEMICAL SECURITY PROGRAM  
Chemical SAFETY AND SECURITY TRAINING



## Chemical Safety and Security Plan

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**CSP** CHEMICAL SECURITY PROGRAM  
Chemical SAFETY AND SECURITY TRAINING

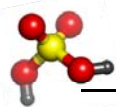


## First step: Collect information

- ▶ Writing a good CSS plan requires a lot of information
- ▶ Assessment questionnaires can be used to collect such information
- ▶ Distribute to:
  - PIs
  - Management
  - Facilities
  - Security
  - Medical

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**CSP** CHEMICAL SECURITY PROGRAM  
Chemical SAFETY AND SECURITY TRAINING

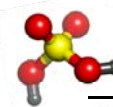


## Assessment Questionnaire

- ▶ Who is responsible for CSS compliance?
  - Criteria for exposure control
  - Developing exposure control measures
  - Exposure monitoring
  - Identification of hazardous materials
  - Limited access policy
  - Ventilation maintenance
  - Safety equipment
  - Personal protective equipment
  - Training
  - Hazardous waste management
  - Medical surveillance
  - Emergency response



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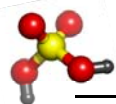


## Assessment Questionnaire, continued

- ▶ List individuals (managers, Pls, professionals, technicians) with Safety & Security responsibilities;
  - indicate SO, CSSO, BSO, RSO, etc.
- ▶ Who maintains CSS records?
- ▶ Is there a Safety/Security Committee?
  - Responsibilities
  - Who are the members?
  - How often do they meet?
- ▶ Is there a CSS Manual, Plan?
- ▶ Are there CSS policies?
- ▶ Is there an Emergency Response Plan?
- ▶ Are routine CSS inspections conducted?
  - By whom
  - Details



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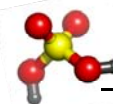


## Chemical Safety and Security Plan

- ▶ Includes CSS Policy Statements from senior management.
- ▶ Describes the entire Program.
- ▶ Describes the organization of the Program.
- ▶ Explains everyone's responsibilities.
- ▶ Describes in general terms policy and who, what, where and why a safety or security task or job is performed.
- ▶ Includes references, if necessary.



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## Parts of a Chemical Safety and Security Plan

- ▶ Policy statement from Senior Management
- ▶ Safety & Security Organization
  - Management
  - Responsibilities
    - Management
    - Administration
    - CSSO staff
    - Facilities Management
    - Principal Investigators
    - Staff
    - Contractors
  - Policy areas:
    - General housekeeping
    - Eating, smoking areas
    - Signs & labels
    - Emergency procedures
    - Chemical storage
    - Personal protective equipment
    - Respirator protective program



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## Parts of a Chemical Safety and Security Plan, continued



- ▶ Engineering Controls
  - Ventilation
  - Laboratory hoods
- ▶ Waste Management
- ▶ Training
- ▶ Record keeping
- ▶ Fire Protection & Protection
- ▶ Location of emergency equipment
- ▶ Evacuation plans
- ▶ Personal and environmental monitoring
- ▶ Inspections
- ▶ Medical surveillance
- ▶ Administration
  - Purchasing chemicals
  - Purchasing safety equipment

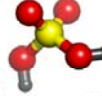






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## Standard Operating Procedures (SOPs)



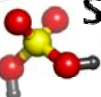
- ▶ An SOP explains *concisely and precisely* how, where and who performs a task.
- ▶ It does *not* explain why the task is done.
- ▶ The Safety and Security Plan explains policy and why a task is performed





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## Standard Operating Procedures (SOPs), continued



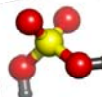
- ▶ SOPs are:
  - Dated
    - When issued
    - When reviewed
    - When revised
  - Have: subject, title and identification code
  - Officially reviewed by management
  - Signed by all responsible parties
  - May include forms
  - Written in a consistent and official format with numbered pages

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## Standard Operating Procedures (SOPs), continued




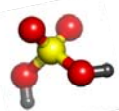
Consider written SOPs on:

- Security clearance and visitor access
- Employee training
- Medical surveillance
- Respiratory protection and fit
- Eye protection
- Ventilation system maintenance
- Storage, receipt, transport & shipping of hazardous materials
- Accident & emergency response including natural disasters
- Special operations, radiation, biosafety, lasers, infectious agents
- Spill cleanup
- Waste management
- Hazardous material handling



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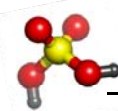


## Plan and SOP Revision Guidelines

- ▶ CSS Plan → As needed, every 5 years
- ▶ (M)SDS → As received
- ▶ Laboratory Hoods → As needed
- ▶ Training records → Yearly, and as needed
- ▶ Medical Surveillance records → As needed, and every 12–18 months
- ▶ Exposure monitoring } As needed
- ▶ Waste records }



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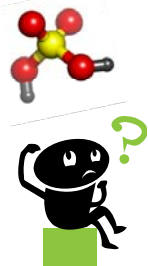


## Record Retention Recommendations

- ▶ Personal records kept by Human Resources for the duration employment + 30 years.
- ▶ Medical records are *confidential* and should be kept by the examining physician for duration of employment + 30 years.
- ▶ Most other records (e.g., routine monitoring, should be kept for 5 years after date of performance).



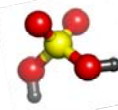
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Questions?  
Open Discussion



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# Adjourn

